

Evaluation of chemical components of sweetener produced from date (*Phoenix dactylifera*) fruits

G.O Babarinde*, B.A. Akinwande, G.M. Adegbola and O. S. Olaleye

Department of Food Science and Engineering, Ladoke Akintola University of Technology, Ogbomosho, Nigeria.

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ABSTRACT

Production of date syrup as use for sweeteners in food has become very essential in view of the high consumption of table sugar which is high in calories and has been a precursor to certain ailment such as increased risk of cardiovascular disease, obesity and diabetes. This work was designed to produce sweetener from date fruits and to determine the chemical properties, microbial and sensory attributes of the sweetener. Date fruits were sorted washed and wet milled. Slurry obtained was screened and filtrate was poured into an evaporator. Sweetener was analysed for pH, brix, proximate, vitamins B₁ and C acceptability of the product was determined. The syrup obtained was a brown coloured viscous liquid of 5.71 Pa s at 25°C. pH of date syrup was 4.95. The moisture content was 23.75%. The results for protein, ash, crude fiber and fat were 2.41, 1.81, 0.14 and 1.21% respectively. Significant values of vitamins B₁ and C were observed. The date sweetener had a brix of 71.5 which indicate high sweetening value. The product compared favourably with honey in terms of sensory attributes. Application of sweetener produced from date syrup will serve as a means of increasing the nutritional value of food, when added.

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Introduction

Date fruit (*Phoenix dactylifera*) is one of the oldest cultivated tree crops, and has been grown for thousands of years (Tang *et al.* 2013). Date has a high nutritional value as well as sweetening value which can be utilized into a sweetener and could be a source of minerals and vitamins when added to food (Abekhti *et al.*, 2013). Date contains all the essential amino acid, it assists in digestion maintains healthy nervous system, prevent night blindness, boost energy and alleviates constipation Al-Harrasi *et al.* (2014). Date is a food of high nutritional value, bioactive compounds and beneficial to human health (Alfarsi *et al.*, 2005). It is ready for immediate consumption and is therefore infinitely superior to cane sugar. It is also taken in several food forms. The seed of the fruit when roasted and ground into powder makes a beverage like coffee, called date coffee. The date palm yields a sweet juice of high food value. It can be taken fresh with great advantage or make it into a tasty county sugar. Considering the nutritional importance of date fruits and its health benefit, production of nutritive sweetener from date palm as alternative to table sugar and synthetic sweeteners in food has become very essential. High consumption of table sugar has been associated to certain ailment such as increased risk of cardiovascular disease, developing cavities, a risk factor of weight gain, obesity and diabetes (Fried and Rao, 2003). Artificial food sweetener was reported by Neacșu and Madar (2014) as detrimental to health and development of the brain. The production of sweetener from dates will increase its potential, diversify its use and also reduce the problem associated with consumption of synthetic sweeteners.

This work was designed to produce sweetener from date fruits and to determine the chemical composition, microbial and sensory attributes of the sweetener.

Material and Methods

Date palm fruits were obtained from Markurdi, Nigeria and the production was carried out at Owodunni Food Processing Laboratory, Ladoke Akintola University of Technology, Ogbomosho, Nigeria.

Samples preparation

Date fruits were sorted, cleaned and washed to remove dust particles. It was cut transversely to remove the hard corny seeds. The pericarp was washed, drained and cut into smaller pieces to increase the surface area and to ease milling. The reduced sizes were wet milled and sieved in a muslin cloth continuously to extract the sweetening component of the fruit into water. The sample was thoroughly squeezed until the residue has no sweet taste. The residue was discarded and the filtrate obtained was taken to the evaporation room for further processing (Fig 1).

The evaporation flask was cleaned and the filtrate to be evaporated was poured into it. The flask was connected to the rotary drive by the vapour duct. The rotary drive provides constant rotation of the evaporation flask and is connected to the control unit for automatic control of the rotation speed. The evaporation flask is immersed in the water bath that had been preset to 100°C to evaporate water. The mixture continues to boil until the sample in the evaporation flask turns into syrup. The evaporator was removed and syrup was poured into a 500 ml beaker to cool.

Analyses

Viscosity of the sample was determined using viscometer at a constant of 4.697 and the viscosity for the syrup was displayed on the meter (Food and Drug Administration, 1982). Moisture content was determined by drying samples in oven at 105°C until constant weight was reached. Protein was determined using Kjeldahl method.

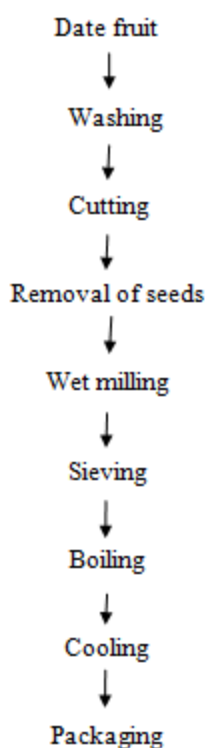


Fig 1. Flow chart for date sweetener production.

The nitrogen value was converted to protein by multiplying with conversion factor. Crude fat was estimated using Soxhlet extraction method. Sample was incinerated in a muffle furnace at 550°C to determine the ash content. Carbohydrate was determined by difference and crude fiber was estimated according to AOAC (2005) method. The pH, brix, Vitamins A and B₁ were determined according to AOAC (2005) methods. Ascorbic acid content was determined according to the method of Kirk and Sawyer (1991) using 2, 6, dichlorophenol indophenols visual titration.

Sensory Analysis

Consumer's acceptability of the product was determined. Sample was compared with a commercial honey obtained from LAUTECH Apiary farm and table sugar using 30 panel of judges who are regular user of honey and synthetic sweetener. Samples were served at room temperature to the judges to rate them on the basis of taste, flavour, colour and general acceptability. The rating was done using hedonic scale of 1 – 7 (where 1 = dislike extremely; 2 = dislike moderately; 3 = dislike slightly; 4 = neither like nor dislike; 5 = like slightly; 6 = like moderately and 7 = like extremely).

Results and Discussion

The date syrup obtained is a light golden brown coloured viscous liquid of 5.71 Pa s at 25°C. Viscosity of food product is an important parameter required in the production of food which is the quantity that describes a fluid resistance to flow. The chemical composition of date syrup is shown in Table 1. pH of date syrup was 4.95 indicating acidity which retards microbial growth (Willey *et al.*, 2008). Each species of microorganism has a definite pH growth range and pH growth optimum. A low moisture content and high acidity are two important positive attributes for storage and potential manufacturing uses of sweeteners (Mrabet *et al.*, 2008). The proximate composition of sweetener from date fruits is presented in Fig 2. The moisture content of syrup obtained from date was 23.75% which is higher than the moisture content of date fruits. This is as a result of processing which involves the addition of water. Water acts only as a temporary

carrier to facilitate the subsequent separation of the residue from the filtrate which was removed by evaporation (Barreveld, 1993). The carbohydrate content is 70.68 and this was obtained by difference. The amount obtained (Fig 2) was within the range (68.53-75.37 g/100 g) reported by Ali *et al.* (2009) when total carbohydrate of three cultivars of date was determined. Makki *et al.* (1998) reported that carbohydrate content in date can constitute up to 78% and provide a readily available source of energy to human body.

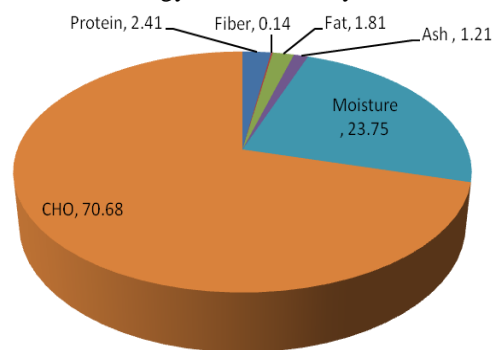


Fig 2. Proximate composition (%) of sweetener from date palm fruits.

The crude fibre obtained from the processed sweetener is 0.14%. This also makes this sweetener a better choice as most synthetic sweetener lack fiber. Percentage ash content of produced sweetener is 1.21. The value obtained was within the range (1-2%) reported by Al-Harrasi *et al.* (2014) for different varieties of dates in Ad Dakhliya region, Sultanate Oman. Significant amount of protein (2.41%) was observed in the sweetener produced (Fig 2). The amount of protein obtained in this study was higher than the values (0.36 – 1.02%) reported for honey from different sources by Chua and Adnan (2014). Synthetic sweeteners lack protein and presence of protein in date sweetener is of nutritional importance. This shows that alternative use of date syrup as sweetener will increase nutritional values of food and minimize problems of protein energy malnutrition. Nasir *et al.*, (2015) reported average protein contents of fresh and dried dates as 1.50 and 2.14 g/100 g, respectively. Al-Harrasi *et al.* (2014) reported that protein content of date pulp ranged between 1.7% and 2.95% on fresh weight basis. Value of date protein after processing to sweetener was within the reported range. However, the protein content was not adversely affected by processing.

Table 1. Vitamins and chemical composition of sweetener.

Parameter	Amount
Vitamin A (mg/ml)	0.35±0.00
Vitamin B (mg/ml)	0.14±0.00
Vitamin C (mg/ml)	0.21±0.01
pH	4.95±0.02
Brix	71.5±0.71
Viscosity (Pa.s)	5.71±0.01
Colour	1.81±0.01

± standard deviation

Results obtained from vitamins A, B₁, and C are 0.35, 0.14, 0.21 mg/100g respectively (Table 1). Amounts present in date sweetener after processing were within the range (0.1-916 mg/100g) reported by Al-Farsi *et al.* (2005) for date fruits. The presence of these vitamins in the product made it a nutritive one. Maple syrup a nutritive sweetener also contained trace amount of vitamins (Ball, 2007). This implies that sweetener from date compared favourably with other nutritive sweeteners.

The sweetener has a brix of 71.5 which indicate high sweetening value and this makes it a good choice of sweetener. The brix of date fruits ranges from 70-75 (Barreveld, 1993). Sucrose obtained from sugar cane is basically sugar with about 0.5% moisture.

Table 2. Sensory attributes of sweetener produced from date palm fruit.

Parameters	Honey	Date sweetener	Sugar
Colour	5.38 ^a	5.31 ^a	6.62 ^a
Flavour	5.23 ^a	4.64 ^a	6.46 ^a
Taste	4.85 ^a	5.00 ^a	6.54 ^a
General acceptability	4.92 ^a	4.92 ^a	6.69 ^a

Means followed by the same letters are not significantly different ($p < 0.05$)

The product compared favourably with honey and sugar because there was no significant difference in colour taste and general acceptability, although sugar was rated best. In terms of flavour, honey has a higher preference value than the product, the taste of the date syrup is more preferred than honey but the general acceptability is rated the same.

Conclusion

The product obtained has a high sweetening value. It also had significant amount of protein, vitamins, ash and fiber. The use of sweetener produced from date syrup will serve as a means of increasing the nutritional value of the food when added.

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